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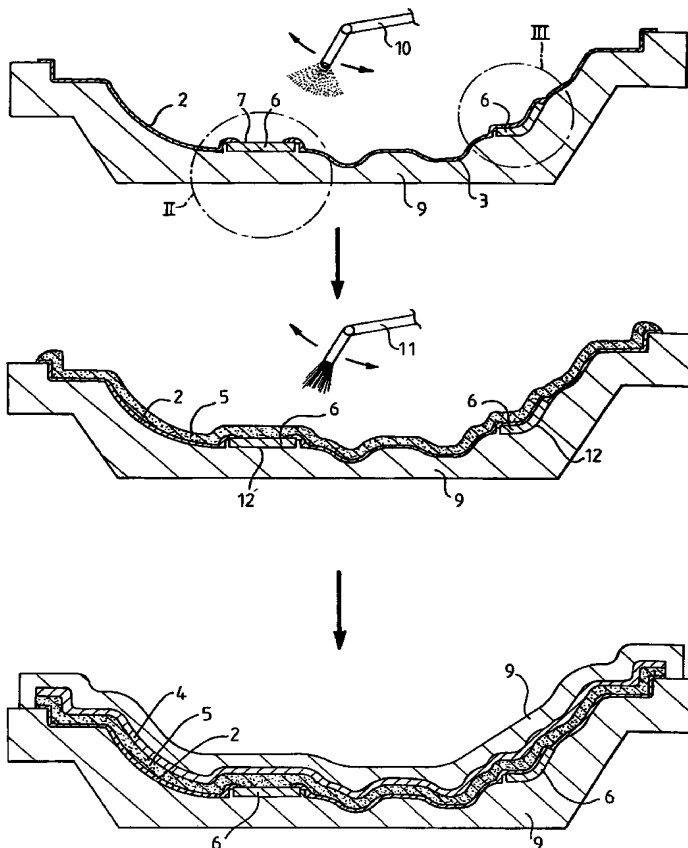
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(54) Title: METHOD FOR MANUFACTURING AN AUTOMOTIVE TRIM PART



(57) Abstract: A method for manufacturing at least a skin (2) for forming a visible front surface (3) of an interior trim part which comprises at least one pre-manufactured insert (6) showing a back face (7) situated at a distance behind said visible surface. The skin is made by applying at least one flowable skin material for producing an elastomeric, non-cellular or micro-cellular plastic skin (2) against at least one surface of a mould (9) and by allowing this flowable skin material to harden. Before uniting any structural backing layer (4) or intermediate foam layer (5) to the back side of the skin, the pre-manufactured insert is adhesively fixed to said skin material. Use is preferably made as said flowable skin material of a reactive polyurethane mixture. The pre-manufactured insert is preferably adhesively fixed, at least partially by the adhesion of said flowable skin material itself before it has completely hardened. This method allows to integrate the inserts easier in the trim parts and to achieve a qualitative visual transition between the plastic material of the skin and the inserts.

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METHOD FOR MANUFACTURING AN AUTOMOTIVE TRIM PART

The invention relates to a method for manufacturing at least a skin of a plastic material, in particular a flexible skin, destined for forming a visible front surface of a trim part arranged to be mounted in particular in an automobile vehicle to form a part of the interior thereof, which trim part comprises at least one pre-manufactured insert showing a back face situated at a distance behind the visible surface formed by said plastic material, in which method the skin is made by applying at least one flowable skin material for producing an elastomeric, non-cellular or micro-cellular plastic skin against at least one surface of a mould and by allowing this flowable skin material to harden to achieve said plastic material. For manufacturing the trim part itself, at least a structural backing layer is united to the back side of the manufactured skin, preferably through the intermediary of an intermediate foam layer.

In the automotive industry, interior trim parts such as dashboards, door panels, covers or other facing panels are getting more and more complex. New car options, such as electronic devices, have to be integrated in a minimum of available space to improve the comfort level and demands of the driver. Even more, the demands from an aesthetic point of view are getting higher as well. New colours, grains, materials are integrated to make the car interior look more attractive.

Another trend is the individualisation of cars. Car drivers want their car to be identified with their personality. They need a higher choice of inserts to create a personal touch in their vehicle. A higher

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pallet of colours, materials, functions are needed to make a possible customer decide for a specific car. Today, manufacturing processes are limited to a particular amount of versions and options, due to logistics and costs reasons.

5 Today's manufacturing methods for automotive interior trim parts are usually based on the following concept:

- manufacturing an aesthetic visible material (skin or foil) which may be formed of one base layer or of a base layer covered with a paint, in particular with a so-called inmold paint or with a paint applied
10 afterwards onto the skin;
- combining this aesthetic material with a self-supporting carrier or in other words with a structural backing layer either in a one step process, wherein a rigid PU system is for example applied by R-RIM (Reinforced Reaction Injection Moulding) against the back of the skin,
15 or in a two step process, wherein the carrier is pre-manufactured for example by an injection moulding process from rigid ABS and combined, in a second step, with the skin using for example a PU back foaming process;
- die-cut these parts to allow integration of separately pre-manufactured
20 inserts to be assembled in the self-supporting part.

 Assembling the pre-manufactured insert in the trim part is a complex job as a high amount of inserts or tools, wires, etc. have to be mounted resulting in high production costs. Moreover, the different inserts of a wide range of materials have to fit perfectly into the holes cut
25 in the part. Deviations in size of holes and/or inserts result in poor visual quality, which may be the result of the large temperature fluctuations which may occur in the car (from -35°C to +130°C) or of tolerances of die cut processes of parts.

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Another problem of inserts which are mounted into trim parts is that they may be at the origin of annoying squeaking noises when the vehicle drives for example over a bumpy road. These squeaking noises are the result of vibrations of the insert relative to the skin or other layers of the trim part and of the rubbing action caused thereby. In view of the high quality demands, these squeaking noises are an important problem in the automotive industry and are often very difficult to avoid.

An object of the present invention is therefore to provide a method for manufacturing a trim part for an automobile vehicle's interior and a skin therefor which allows to integrate the inserts easier in the trim part and which enables moreover to achieve a qualitative visual transition between the visible surface of the trim part formed by the skin and the inserts when these remain visible on the final part in the vehicle.

To this end, the method according to the invention is characterised in that said pre-manufactured insert is positioned in said mould and is adhesively fixed to said plastic material, in particular at least partially by the adhesion of said flowable skin material itself, before it has completely hardened.

For integrating the pre-manufactured inserts in the trim part, they do no longer have to be assembled in holes in the trim part itself but they can be fixed to the skin when making this skin without having to die-cut holes therein. Fixing the insert to the skin can be done in the method according to the invention in accordance with different embodiments.

In a first embodiment, the pre-manufactured insert is positioned against the mould surface and the flowable skin material is subsequently applied against the mould surface and against at least one side of the pre-manufactured insert in a layer extending at least partially

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over the mould surface and over said side of the insert to fix the insert to the skin.

In the thus manufactured skin, the insert remains visible on the trim part unless it is covered by a finishing element fixed later on to the insert.

Since the inserts are integrated in and fixed to the skin when moulding this skin from the flowable skin material, a qualitative visual transition can be obtained between the inserts and the skin, even in case of some dimensional variation of the inserts or after a prolonged exposure to strongly fluctuating temperatures. Due to the fact that the skin is fixed to the inserts, it will be more dimensionally stable so that even after a long exposure to fluctuating temperatures, the quality of the transitions between the inserts and the skin will be maintained. In the prior art methods, such a dimensionally stable skin was, on the contrary, not automatically obtained and metal reinforcing wires were for example applied in the foam backing layer, against the back of the skin, in order to avoid deformations of the skin or trim part.

In a second embodiment, the insert shows a front face and is maintained in the mould with its front face at a distance from the mould surface against which the skin is moulded and the flowable skin material is applied between the mould surface and the front face of the insert to cover the front face of the insert with said skin material.

In this embodiment, the insert can easily be integrated in the skin by using an injection process, in particular a RIM process performed in a closed mould wherein the visible front face of the skin is made against one mould surface and wherein the insert is removably attached to the opposite mould surface to maintain it at a distance from the first mould surface so that the flowable skin material can penetrate between the front face of the insert and the mould surface.

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In a third embodiment, the insert shows a front face and, is maintained with its front face at a distance from the mould surface against which the skin is moulded by applying, before positioning the pre-manufactured insert into the mould, a first layer of the flowable skin material against the mould surface and by positioning the insert onto this first layer, preferable before this layer of flowable skin material has completely hardened so as to adhere the insert to this layer.

In this embodiment, the first layer of flowable skin material, preferably a reactive polyurethane mixture, is preferably sprayed, in an open mould, against the mould surface. Just after the spraying, the insert can easily be positioned onto the back of this spray layer.

When positioning the insert against the mould surface in accordance with the first embodiment, the flowable skin material can be applied either by a spray process in an open mould or it can be poured or injected in a closed mould, in particular in accordance with a reaction injection moulding (RIM) process in case the flowable skin material consists of a reactive mixture.

In the different embodiments of the method according to the invention, use is preferably made as said flowable skin material of a reactive mixture for obtaining an elastomeric, non-cellular or micro-cellular polyurethane skin. An advantage of the use of a reactive mixture is for each of the different application methods (spraying, pouring or injecting) that tool pressures and tool temperatures are relatively low so that there is substantially no risk of damaging the appearance or characteristics of the integrated inserts, whether these inserts are mechanical, aesthetic and/or functional or electronic inserts.

In the prior art, US-A-4 810 452 discloses already a process for making a facing panel for a vehicle's interior, in particular a

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door panel, wherein fragments of moquette and/or of fabric are first positioned into recesses in a mould surface so that the back sides of these fragments are flush with the mould surface. Subsequently, a continuous layer of polyurethane reaction mixture is sprayed onto the surface formed by the mould surface and by the back of the fragments.

5 In contrast to the method according to the present invention, this known process is only suited for applying thin layered covering materials onto the outside of the facing panel. In the method according to the invention, the inserts may show a considerable thickness, and may thus be formed

10 by functional elements, since these inserts are not applied on the surface of the skin of the trim part but are on the contrary at least partially recessed within the visible surface formed by the skin, i.e. their back face is situated at a distance behind the visible surface formed by the plastic material of the skin. The inserts may even have a thickness larger than

15 the thickness of the surrounding portion of the trim part itself so that they extend beyond the surface formed by the back of the structural backing layer or carrier in the area around the insert.

In the prior art, WO95/32850 further discloses a method for manufacturing an elastomeric skin of two or more differently coloured elastomeric polyurethane materials. In this method, a portion of the mould is shielded off by means of a mask whilst the elastomeric material of the first colour is sprayed onto the uncovered part. Subsequently, the mask is removed and the elastomeric material of the second colour is sprayed onto the mould surface and partially onto the first skin layer

20 which has already been applied. Then, a foam layer and a structural backing layer are applied. A drawback of this known technique is that both skin parts have to be made from a same kind of material in the mould itself. Moreover, since separate reactive mixtures and separate spraying apparatus have to be provided for each different colour, the

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variation of the colours during the manufacturing process is limited. In the method according to the present invention, use is on the contrary made of pre-manufactured inserts which are positioned in the mould and which may not only provide aesthetic variations in the skin but also functional elements. The integration of such pre-manufactured inserts in the skin and subsequently in the trim part is not disclosed in WO95/32850.

In an advantageous embodiment of the first embodiment of the method according to the invention, the mould surface shows an upstanding edge and the pre-manufactured insert a lateral side by means of which it is positioned in abutment against the upstanding edge in the mould.

An advantage of this embodiment is that the upstanding edge enables to prevent the flowable skin material from covering the lateral side of the insert and from penetrating more particularly up to the front face of the insert. In other words, the upstanding edge enables to obtain a sharp and clean transition between the visible surface of the skin and the insert on the visible side of the trim part.

In a preferred embodiment of the method according to the invention, the pre-manufactured insert shows a front face and is positioned in the mould with this front face substantially flush to the mould surface against which the skin is moulded.

In this embodiment, the insert is preferably left uncovered so that it forms part of the visual surface of the trim part.

In another preferred embodiment of the method according to the invention, the insert shows a front face and is maintained in the mould with its front face at a distance behind the mould surface against which the skin is moulded so that its front face is recessed within the visible surface formed by the skin, said flowable skin material being prevented from entirely covering the front face of the

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insert, in particular by positioning the insert onto an upstanding edge or onto a raised portion of the mould surface, so that the skin forms a recess in front of the insert.

5 In this embodiment, it is possible to arrange a finishing element in the recess in front of the insert, the front face of which may in particular be flush to the visible surface of the skin. This embodiment also enables to obtain a qualitative transition between the skin and the front face of the finishing element amongst others since the edge of the skin is fixed at the periphery of the finishing element to the insert and is in other
10 words dimensionally stable even after prolonged exposure to the large temperature variations in a vehicle.

The present invention also relates to a skin, in particular a flexible skin, for forming a visible front surface of a trim part arranged to be mounted in particular in an automobile vehicle to form a part of the
15 interior thereof, which skin is made of an elastomeric, non-cellular or micro-cellular plastic material, in particular in accordance with the method according to the invention and is characterised in that it comprises at least one pre-manufactured insert which is adhesively fixed to the plastic material of the skin and which shows a back face situated at a distance
20 behind said visible surface.

Other particularities and advantages of the invention will become apparent from the following description of some particular embodiments of the method and the skin according to the present invention. This description is only given by way of illustrative example
25 and is not intended to limit the scope of the invention as defined in the annexed claims. The reference numerals used in this description relate to the annexed drawings wherein:

Figure 1 shows schematic cross sectional views through a mould illustrating the successive steps of a method for moulding a trim

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part for an automobile vehicle's interior, in particular a dashboard, in accordance with a particular embodiment of the method according to the present invention;

5 Figure 2 shows an enlarged view of detail II in Figure 1 being an aesthetic insert abutting an upstanding edge provided on the mould surface and having a back partially covered with the polyurethane material of the skin;

10 Figure 3 shows an enlarged view of detail III in Figure 1 being an aesthetic insert abutting on only one side an upstanding edge provided on the mould surface and having a back which is entirely covered with the polyurethane material of the skin;

 Figures 4 and 5 illustrate decorative frames inserted in the gaps around the inserts;

15 Figures 6 to 8 show enlarged views similar to the view of Figure 2 but relating to some variant embodiments;

 Figures 9 to 12 illustrate different embodiments of flexible lips on the inserts;

20 Figure 13 shows an enlarged view similar to the view of Figure 2 but illustrating the integration of a functional mechanical insert in the trim part, more particularly a ventilation housing, and having the foam backing layer and the structural backing layer or carrier applied thereto as illustrated in Figure 1;

25 Figure 14 shows the ventilation housing of Figure 13 integrated in the trim part removed from the mould and having its back die-cut to provide a hole through which adjustable ventilation blades are mounted in the lid;

 Figure 15 shows an enlarged view similar to the view of Figure 13 but illustrating the integration of a functional electronic insert in

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the trim part comprising for example an electronic PLC device and switches and LEDs;

Figure 16 shows an enlarged view similar to the view of Figure 13 but illustrating the integration of a mechanical connector formed by a threaded ring in the trim part;

Figure 17 shows the mechanical connector of Figure 16 integrated in the trim part removed from the mould and having a finishing element assembled in the recess formed in front of the mechanical connector in the trim part;

Figure 18 shows an alternative embodiment of the mechanical connector illustrated in Figure 17;

Figure 19 shows a view similar to the view of Figure 16 but showing the integration of an insert with a mechanical and an electric connector;

Figure 20 shows an enlarged view similar to the view of Figure 2 but illustrating the integration of an electric switch and other parts of an electronic or electric circuit within the skin.

The invention generally relates to a method for manufacturing a trim part 1 for an automobile vehicle's interior, in particular interior trim parts such as dashboards, doorpanels, consoles, glove compartments, etc. or at least a skin 2 therefor which forms the visible front surface 3 of such trim parts 1 or panels. In addition to the skin 2, the trim part 1 comprises at least a structural backing layer 4 or rigid carrier united to the back side of the skin 2, usually through the intermediary of an intermediate foam layer 5. In the method according to the invention, at least one pre-manufactured insert 6 is further integrated in the trim part 1. This insert 6 may be composed of an aesthetic, a functional or an electronic element. An essential feature of the invention is that the insert 6 shows a back face 7 situated at a distance behind the

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visual front surface 3 formed by the skin 2 or, in other words, that the insert 6 is not simply applied, for example adhered, with its back face 7 onto the front surface 3 of the skin 2 like in US-A-4 810 452.

5 The skin 2, which is preferably a flexible skin, is made by applying at least one flowable skin material for producing an elastomeric, non-cellular or micro-cellular plastic skin against at least one surface 8 of a mould 9. The skin has normally an average thickness in the range of 0.1 to 3 mm and usually in the range of 0.5 to 1.5 mm whilst its density is usually higher than 400 kg/m³ and preferably higher than 700 kg/m³ due
10 to the fact that the skin is non-cellular or micro-cellular. For determining the average thickness of the skin or other layers, the volume and the surface area of the skin are measured and the volume is divided by the surface area. The flowable skin material may be a molten thermoplastic material, in particular TPE's (= thermoplastic elastomers) such as TPO,
15 PVC, EV, ... In accordance with the present invention, preference is however given to the use of a reactive mixture for obtaining an elastomeric, non-cellular or micro-cellular polyurethane material. An advantage of the use of a reactive mixture is that tool pressures and tool temperatures can be kept relatively low so that there is substantially no
20 risk of damaging the appearance or characteristics of the integrated inserts. In the further detailed description, reference will be made only to the use of such a reactive mixture but for a person skilled in the art, it will be clear that the skin can also be made from thermoplastic materials and this in accordance with the existing moulding techniques for such
25 materials

In the preferred embodiment, the reactive polyurethane mixture can either be applied by a spray process against the surface 8 of an open mould or it can be applied in a closed mould, more particularly poured but preferably injected in accordance with a reaction injection

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moulding (RIM) process. The spray, the pouring and the RIM processes are known per se so that they need not be described into further detail. For the spray process, reference can moreover be made to the technique described in European patent EP-B-0 303 305.

5 As reactive polyurethane mixture, use can be made of a light-stable, mass-stained coloured polyurethane reaction mixture as disclosed for example in European patent EP-B-0 379 246 for a spray process and in WO98/14492 for a reaction injection moulding process. Both these patent publications are incorporated herein by way of
10 reference with respect to the particular compositions disclosed therein.

 In a variant embodiment, a finishing layer, in particular a light-stable polyurethane paint or in other words a so-called PU in mold paint that may be either water based or solvent based, can be applied first against the mould surface. This paint composes together with the
15 elastomeric layer applied thereto subsequently, the skin 2. In this embodiment, the elastomeric layer does not necessarily have to be light stable so that use can be made of an aromatic polyurethane system for this layer.

 The structural backing layer 4 or carrier which is applied
20 against the back of the skin 2 can be made of various materials such as PVC, ABS, SMA, PU, etc. which provide the necessary strength to the trim part 1 in order to render it self-supporting. The backing layer 4 can be formed in situ, by a one step process, against the back the skin 2, in particular starting from a rigid PU system applied by an S-RIM (Structural
25 RIM) or an R-RIM (Reinforced RIM) process in a closed mould or by a spray technique in an open mould as disclosed for example in European patent EP-B-0 642 411. Optionally, a polyurethane foam system can first be applied against the back of the skin 2 to form an intermediate foam

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layer 5 in order to improve the touch comfort of the panel (see also EP-B-0 642 411).

5 The structural backing layer 4 can also be applied in a two step process against the back of the skin 2. In such a process, the backing layer 4 is for example first moulded in accordance with an injection or a reaction injection process. In the second step, it may then for example be glued directly to the back of the skin 2. In order to improve the soft touch of the trim part 1, it is however usually united to the back of the skin through the intermediary of an intermediate foam
10 layer 5 which is formed in situ between the skin 2 and the structural backing layer 4. The reactive polyurethane or other mixture for such a foam can either be poured onto the skin 2 just before applying the rigid backing layer 4 thereto or can be injected between the skin 2 and the backing layer 4.

15 A characterising feature of the method according to the invention is the way wherein the pre-manufactured insert or inserts 6 are integrated in the trim part 1. These inserts 6 are more particularly adhesively fixed to the plastic material of the skin, preferably at least partially by the adhesion of said flowable skin material itself, before it has
20 completely hardened or in other words before the reactive mixture is completely cured. Since the insert is fixed to the skin layer, the skin 2 remains dimensionally stable around the insert so that a qualitative transition can be obtained whilst squeaking noises can also be avoided by this fixation. Moreover, no further assembling steps are required to
25 mount the insert in the trim part. However, this does not preclude the subsequent mounting of other elements onto the trim part or onto the inserts integrated therein by the process according to the invention.

Figure 1 illustrates schematically one way wherein the method according to the invention can be carried out for manufacturing a

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trim part 1 for an automobile vehicle's interior, more particularly a dashboard. In this embodiment, the pre-manufactured insert or inserts 6 are fixed to the skin 2 by positioning them against the mould surface 8 and by applying the reactive mixture for the skin 2 subsequently against
5 this mould surface 8 and against at least one side of the inserts 6 in a layer extending at least partially over the mould surface 8 and over said side of the inserts 6.

In the embodiment of Figure 1, use is made of a two-part mould 9. Before positioning the inserts 6 therein, a mould release agent
10 and/or an in mold coating can optionally first be sprayed in the mould 9. In the illustrated embodiment, the inserts 6 are positioned against the mould surface 8 of the lower mould part. Subsequently, a reactive polyurethane mixture is sprayed by means of a spray gun 10 in a layer extending over the mould surface 8 and at least partially also over the back faces 7 of
15 the inserts 6.

In a second step, a reaction mixture for obtaining a polyurethane foam layer 5 is poured by means of a pouring nozzle or mixing head 11 onto the back of the polyurethane skin 2, preferably
20 when the skin 2 is still somewhat sticky. In case of undercuts, the skin made in the first step should be transferred to a second mould, the lower mould part of which consists of two or more parts allowing to demould the trim part.

Then, in a third step, the uppermost part of the mould 9 having a pre-manufactured structural backing layer 4 attached thereto is
25 closed and the skin and the intermediate foam layer are allowed to cure before demoulding the thus obtained trim part 1. In this embodiment, the structural backing layer 4 may be made in particular of a thermoplastic material such as for example ABS or SMA (styrene maleic anhydride) which can be injected in a separate injection mould. Of course, it is also

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possible to make the structural backing layer for example of a reactive polyurethane or polyisocyanurate mixture.

Instead of pouring the foam material in the mould 9 before closing it, this foam material can also be injected, after having
5 closed the mould 9, between the skin 2 and the structural backing layer 4.

In a further variant embodiment, the reactive mixture for obtaining the polyurethane foam layer 5 can be sprayed in the second step by means of a spray gun onto the back of the polyurethane skin 2.
10 When the intermediate foam layer 5 has thus been formed, the mould is closed and a suitable reaction mixture, for example a polyurethane or a polyisocyanurate reaction mixture, for obtaining the rigid structural backing layer 4 can then be injected into the mould cavity by means of a third spray gun.

15 The inserts 6 illustrated in Figure 1 are intended to remain visible on the final trim part 1 in the car and show more particularly a front face 12 which is left uncovered to form part of the visible surface 3 of the trim part 1. They can be made of aesthetic materials varying from relatively soft to hard such as leather, fabrics,
20 foams, etc. or wood, metal, plastic parts such as ABS (acrylbutadiene styrene), PC (polycarbonate) or even transparent or decorative materials. They can also be masked.

In order to achieve a nicely finished transition on the visible front side of the trim part 1 between the polyurethane material of
25 the skin 2 and the edges of the aesthetic inserts 6, the mould surface 8 is provided with upstanding edges 13 and the inserts 6 are positioned with their lateral sides 14 in abutment against these upstanding edges 13. Figure 2 shows on a larger scale the abutment of one of the inserts with its lateral sides 14 against the upstanding edges 13. In case the visual

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aspect is a particular area is less important as for the second insert of Figure 1, shown on a larger scale in Figure 3, a lower upstanding edge or even no edge at all may be used.

5 In case the visual aspect is important, the upstanding edge or ridge 13 has preferably a base showing a thickness d of between 0.1 and 5 mm and more preferably of between 0.25 and 1 mm. The thickness of this base determines indeed the width of the gap between the elastomeric skin layer and the insert in the final part, optionally with radius, as illustrated for example in Figures 13 and 14, when
10 aesthetically demanded. For aesthetic reasons, it may sometimes be desirable to withdraw the gap from view. This can however easily be achieved by pressing a decorative frame 37, having for example a chrome or a wood look, into the gap. In the embodiment illustrated in Figure 4, the decorative frame 37 has the same width as the gap and
15 provides thus a narrow edge around the insert. Figure 5 illustrates another embodiment wherein the frame 37 shows a decorative head portion which partially covers the adjoining edges of the insert and the skin material. In this embodiment, the frame shows a dovetail to clamp the frame more strongly into the gap.

20 When the insert remains visible, penetration of reactive mixture for the skin between the upstanding edges 13 and the lateral sides of the inserts 6 down to the front face 12 of the inserts is preferably to be avoided. By oversize between the upstanding edges and the insert, a slight pressure will create a sealing for the spray. The upstanding
25 edges 13 have in particular a height h of at least 0.5 mm, preferably a height h of at least 1 mm and most preferably a height h of at least 2 mm. Depending on the viscosity of the reactive mixture, the pressure at which the insert abuts the upstanding edges, etc. soiling of the front face of the inserts by penetrating reactive mixture can thus be avoided. In case the

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insert itself has a too small thickness, the height over which it abuts against the upstanding edge can, if necessary be increased by applying a (foam) backing layer against the back of the insert and/or its peripheral edges can be provided with flanges 15 as shown in Figure 6.

5 As illustrated in Figure 7 the insert 6 can further be provided with a lateral projection 16 by means of which the insert is positioned on top of the upstanding edge 13 so that the projection 16 projects over the upstanding edge 13. Especially when the reactive mixture for the skin 2 is sprayed against the mould surface 8, the shielding effect provided by
10 the lateral projection 16 also contributes in preventing the reactive mixture from penetrating between the insert 6 and the upstanding edge 13. On the other hand, as illustrated in Figure 8, the lateral projection 16 can also be used to suspend the insert 6 onto the upstanding edge 13 so that its front face 12 is maintained at a distance behind the mould surface
15 8 against which the skin is moulded and so that its front face 12 is on other words recessed within the visible surface formed by the elastomeric skin layer 2. In the previously described embodiments, the inserts 6 were on the contrary positioned with their a front faces 12 substantially flush to the mould surface 8 against which the skin 2 is moulded so that at the
20 location of the inserts a nice continuous visible surface was obtained. In some cases, preference can however also be given to positioning the inserts into a small recess in the mould surface so that they project somewhat out of the visible surface of the trim part.

 In Figures 9 to 12 additional embodiments are illustrated
25 wherein an improved sealing between insert 6 and upstanding edge 13 is achieved by means of a flexible lip 38. In Figure 9a, the lip 38 projects obliquely upwards from the top of the lateral side of the insert 6 and is pushed further upwards when positioning the insert against the upstanding edge. In this way, an effective seal is formed as illustrated in

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Figure 9b. A further embodiment of the lip is illustrated in Figures 10a and 10b showing the lip respectively in its undeformed and in its deformed state. Figures 11 and 12 illustrate some further possible shapes of the lip 38. In general both the thickness t and the length l of the lips indicated in the figures will usually be comprised between 0.2 and 5 mm.

The inserts 6 integrated in the skin 2 may not only have an aesthetic function but may also have a functional function. An example thereof is illustrated in Figures 13 and 14. In this example, a ventilation housing 17 positioned between upstanding edges 13 against the mould surface 8 so that a nicely finished transition is obtained between the elastomeric skin layer 2 and the decorative, chrome-like front face 12 of the insert 17. This insert 17 has a closed back face 7 so that its back may be entirely covered with the elastomeric material of the skin 2, the foam layer 5 and the structural backing layer 4. As shown in Figure 14, the back side of the insert 17 can subsequently be opened by die-cutting the different superimposed layers. In this way, not only air can be blown through the ventilation housing but adjustable blades 18 for controlling the direction of the air flow and/or for closing the ventilation opening can be mounted from the back side within the ventilation housing 17. Alternatively, the blades can already be included during positioning of the insert.

A further example of a functional insert 6 is illustrated in Figure 15. In this embodiment a PLC device 19 (Programmable Logic Control) provided with lateral projecting flanges 16 is positioned with these flanges on top of the upstanding edges 13. At its visible front face, the PLC device may show for example several LEDs and switches whilst at its back face, it comprises for example an electrical connector 20. The PLC device has such a large thickness, that spraying of the reactive

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mixture for the skin 2 can be limited to its lateral sides. For preventing the foam material of the intermediate foam layer 5 from covering the back and thus in particular the electrical connector 20 of the PLC device, the pre-manufactured structural layer 4 is provided with a hole surrounded by
5 a downward flange 21 which fits into a groove 22 in the back of the PLC device. In a variant embodiment, only the PLC housing can be integrated first in the trim part, the PLC device itself can then be easily mounted afterwards in this housing.

In the previously described embodiments, the pre-manufactured inserts 6 showed a front face 12 which is left uncovered to
10 form part of the visible surface of the trim part 1. According to the invention, the insert 6 may however also at least partially be hidden from view by fixing a finishing element thereto so as to cover the insert 6. In this case, the insert 6 is preferably maintained with its front face 12 at a
15 distance behind the mould surface 8 against which the skin 2 is moulded so that its front face 12 is recessed within the visible surface 3 formed by the skin 2. The reactive mixture for the skin layer 2 is prevented from entirely covering the front face 12 of the insert 6, in particular by positioning the insert 6 onto an upstanding edge 13 or onto a raised
20 portion 23 of the mould surface, so that the skin 2 forms a recess 24 in front of the insert 6.

Such an embodiment is illustrated in Figure 16. In this embodiment, the insert 6 consists of an internally threaded ring 25 which is positioned onto a shoulder 26 of a raised portion 23 of the mould
25 surface 8. The central part of this raised portion extends up to the upper edge of the ring 25 and prevents the reactive mixture for the skin to enter the ring 25. As shown in Figure 17, when the trim part has been demoulded, a decorative finishing element 27 can be screwed in the threaded ring insert 25, preferably until a decorative front face 28 of this

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finishing element 27 is substantially flush to the visible surface 3 formed by the skin 2. In this case also, a nicely finished qualitative transition can be obtained between the front face of the finishing element and the visible surface of the moulded, elastomeric skin layer 2.

5 Instead of a screw thread, use could also be made of a bayonet closure, a snap-fit connection or any other quick coupling system for fixing the finishing element 27 to the integrated insert 6. The ring could further only provide a guiding housing wherein the finishing element is inserted and fixed on the back of the trim part by a separate
10 fixing element. In this embodiment, a set of different interchangeable finishing elements 27 are preferably provided for being fixed to or through the insert or inserts. An advantage of this embodiment is that a lot of individualisation possibilities can rather easily be offered since the finishing elements can be mounted at the end of the car manufacturing
15 process or even later, for example when the car is already with the salesman or in use. Figure 18 illustrates a possible snap-fit connection between the insert 6 and the finishing piece 27. In practice, a similar snap-fit connection is already used between the structural backing layer 4 and a finishing piece. By the method according to the present
20 invention, the insert is however more accurately positioned with respect to the visible front surface 3 of the skin 2 so that a higher quality transition is obtained between the front face 28 of the finishing element and the front surface 3 of the skin.

 The finishing element 27 may not only have an aesthetic
25 function but could also be formed by a functional, in particular an electronic element. A possible insert for such an element is illustrated in Figure 19. This insert has a shape similar to the ring of Figure 16 but is provided with a chip 29 with connector pins 30 and with a further electrical connector pin 31 connected to an electrical wire 32. The

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finishing element, comprising for examples LEDs and switches or buttons, can be fixed to this insert by a snap-fit connection. In a variant embodiment, an electric or electronic compound could for example also be screwed or snapped in the insert illustrated in Figures 17 and 18
5 respectively. In that case, the electrical wire or wires could be guided through a hole made through the structural backing layer 4 behind the insert 6.

According to the invention, the insert 6 does not necessarily have to be positioned against the mould surface 8 but it can
10 also be maintained with its front face 12 at a distance from the mould surface 8 against which the skin 2 is moulded so that the front face of the insert 6 is covered by the reactive mixture of the skin. This can be done for example by fixing the insert to the upper part of a two part mould and by injecting or pouring the reactive mixture between the mould surface of
15 the opposite mould part and the front face of the insert.

On the other hand, it is also possible and moreover easier to apply, before positioning the pre-manufactured insert 6 into the mould, a first layer 33 of the reactive mixture for the skin 2 against the
20 mould surface 8 and by positioning the insert onto this first layer 33. Use can be made of an a separate adhesive to fix the insert to the first layer 33. The insert is however preferably positioned onto this layer of reactive mixture before it is completely cured so as to adhere the insert 6 to this layer 33. This can quickly be done by a robot since no separate adhesive
25 has first to be applied because, in this case, the insert is also adhesively fixed by the reactive mixture of the skin to the skin. Further fixation of the insert to the elastomeric skin layer can be achieved by the subsequently applied intermediate foam layer or structural backing layer in case no foam layer is applied.

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However, in accordance with the method according to the present invention and as illustrated in Figure 20, a second layer 34 of a further reactive mixture for obtaining an elastomeric, non-cellular or micro-cellular polyurethane material, which may be the same as or different from the reactive mixture used for said first layer 33, is applied, after having positioned the pre-manufactured insert 6 onto the first layer 33, against the back of the first layer 33 and against at least one side of the insert 6. In this way, the insert 6 is not only adhesively bonded to the skin 2 by the reactive material of the first layer 33 but also by the reactive material of the second layer 34. In the case of relatively thin inserts 6, the second layer 34 of the further reactive mixture may also be applied against the back face of the insert 6 so that it will be entirely encapsulated in the skin 2. The second layer 34 of the further reactive mixture is preferably applied before the first layer 33 of elastomeric material is completely cured so that a good adhesion is obtained between both layers without requiring the use of a primer.

In the above described embodiments wherein the front face of the insert 6 is covered by the elastomeric skin layer, the insert is preferably an electronic circuit or a part therefor and comprises in particular an element selected from the group consisting of an electronic print plate, preferably a flexible print plate, electric wiring preferably provided on a flexible print plate, an electric push button, a readable electronic code, a detector, a chip, micro-electronic elements, integrated intelligence elements, smart card technology elements, conductive fibres, interfaces and antennas, car detection system elements or a combination of these elements. The insert illustrated in Figure 20 comprises for example an electrical switch 35 connected to electric wiring provided on a thin, flexible print plate 36 extending within the skin, between the two layers thereof.

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When the insert provides a readable electronic code enabling to identify the car or even to locate it when it has been stolen, an advantage of the above described method is that the coding device can be positioned randomly by the robot onto the first layer so that it cannot easily be removed by a thief since he does not know where the coding device is exactly situated.

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CLAIMS

1. A method for manufacturing at least a skin of a plastic material, in particular a flexible skin, destined for forming a visible front surface of a trim part arranged to be mounted in particular in an automobile vehicle to form a part of the interior thereof, which trim part comprises at least one pre-manufactured insert showing a back face situated at a distance behind the visible surface formed by said plastic material, in which method the skin is made by applying at least one flowable skin material for producing an elastomeric, non-cellular or micro-cellular plastic skin against at least one surface of a mould and by allowing this flowable skin material to harden to achieve said plastic material, characterised in that said pre-manufactured insert is positioned in said mould and is adhesively fixed to said plastic material.

2. A method according to claim 1, characterised in that use is made as said flowable skin material of a reactive mixture for obtaining an elastomeric, non-cellular or micro-cellular polyurethane skin.

3. A method according to claim 1 or 2, characterised in that said pre-manufactured insert is adhesively fixed, at least partially by the adhesion of said flowable skin material itself, to the plastic material of the skin before the flowable skin material has completely hardened.

4. A method according to any one of the claims 1 to 3, characterised in that for manufacturing said trim part, at least a structural backing layer is united to the back side of the manufactured skin, preferably through the intermediary of an intermediate foam layer.

5. A method according to any one of the claims 1 to 4, characterised in that said pre-manufactured insert is positioned against said mould surface and said flowable skin material is subsequently applied against said mould surface and against at least one side of the

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pre-manufactured insert in a layer extending at least partially over said mould surface and over said side of the insert to fix the insert to the skin.

5 6. A method according to claim 5, characterised in that said mould surface shows an upstanding edge and said pre-manufactured insert a lateral side by means of which it is positioned in abutment against said upstanding edge in said mould, said lateral side comprising preferably a flexible lip arranged to abut against said upstanding edge to form a seal for the flowable skin material.

10 7. A method according to claim 6, characterised in that said upstanding edge has a base showing a thickness of between 0.1 and 5 mm and preferably between 0.25 and 1 mm.

8. A method according to claim 6 or 7, characterised in that said upstanding edge has a height of at least 0.5 mm, preferably at least 1 mm and most preferably at least 2 mm.

15 9. A method according to any one of the claims 6 to 8, characterised in that the pre-manufactured insert is positioned on top of said upstanding edge in the mould, in particular a lateral projection of the insert, in a manner such as to project over the upstanding edge.

20 10. A method according to any one of the claims 5 to 9, characterised in that the pre-manufactured insert shows a front face which is left uncovered to form part of said visible surface of the trim part.

25 11. A method according to any one of the claims 5 to 9, characterised in that the pre-manufactured insert is at least partially hidden from view by fixing a finishing element thereto so as to cover the insert.

12. A method according to claim 11, characterised in that said insert and said finishing element comprise mutually co-operating coupling means enabling to fix the finishing element from the front side of

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the trim part to the insert, a set of different interchangeable finishing elements being preferably provided for being fixed to said insert.

13. A method according to any one of the claims 5 to 12, characterised in that the pre-manufactured insert shows a front face and is positioned in the mould with this front face substantially flush to the mould surface against which the skin is moulded.

14. A method according to any one of the claims 5 to 12, characterised in that said insert shows a front face and is maintained in said mould with its front face at a distance behind the mould surface against which the skin is moulded so that its front face is recessed within the visible surface formed by the skin, said flowable skin material being prevented from entirely covering the front face of the insert, in particular by positioning the insert onto an upstanding edge or onto a raised portion of the mould surface, so that the skin forms a recess in front of the insert.

15. A method according to claims 11 and 14, characterised in that said finishing element has a further front face and is inserted in the recess until this further front face is substantially flush to the visible surface formed by the skin.

16. A method according to any one of the claims 1 to 4, characterised in that said insert shows a front face and is maintained in said mould with its front face at a distance from the mould surface against which the skin is moulded and said flowable skin material is applied between the mould surface and the front face of the insert to cover the front face of the insert with said skin material.

17. A method according to any one of the claims 1 to 4, characterised in that said insert shows a front face and, is maintained with its front face at a distance from the mould surface against which the skin is moulded by applying, before positioning said pre-manufactured insert into the mould, a first layer of said flowable skin material against

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said mould surface and by positioning said insert onto this first layer, preferably before this layer of flowable skin material has completely hardened so as to adhere the insert to this layer.

18. A method according to claim 17, characterised in that
5 after having positioned the pre-manufactured insert onto the first layer of said reactive mixture, a second layer of a further flowable skin material for producing an elastomeric, non-cellular or micro-cellular skin, which may be the same as or different from the flowable skin material used for said first layer, is applied against a back side of said first layer and
10 against at least one side of the insert, preferably before the first layer of skin material has completely hardened.

19. A method according to any one of the claims 16 to 18, characterised in that said pre-manufactured insert is an electronic circuit or a part therefor and comprises in particular an element selected from
15 the group consisting of an electronic print plate, preferably a flexible print plate, electric wiring preferably provided on a flexible print plate, an electric push button, a readable electronic code, a detector, a chip, micro-electronic elements, integrated intelligence elements, smart cart technology elements, conductive fibres, interfaces and antennas, car
20 detection system elements or a combination of these elements.

20. A method according to any one of the claims 1 to 19, characterised in that said flowable skin material is applied by spraying against the mould surface.

21. A method according to any one of the claims 1 to 19,
25 characterised in that said flowable skin material is applied against the mould surface by using a closed mould and by filling this closed mould with said flowable skin material either by a pouring or an injecting moulding process, more particularly a reaction injection moulding process.

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22. A method according to any one of the claims 1 to 21, characterised in that said skin is made by applying first a finishing layer against said mould surface, in particular an inmold paint, and subsequently said flowable skin material.

5 23. A method according to any one of the claims 1 to 21, characterised in that said skin is a flexible skin having in particular an average thickness in the range of 0.1 to 3 mm and more particularly in the range of 0.5 to 1.5 mm.

10 24. A skin, in particular a flexible skin, for forming a visible front surface of a trim part arranged to be mounted in particular in an automobile vehicle to form a part of the interior thereof, which skin is made of an elastomeric, non-cellular or micro-cellular plastic material, in particular in accordance with the method according to any one of the claims 1 to 23, characterised in that the skin comprises at least one pre-
15 manufactured insert which is adhesively fixed to the plastic material of the skin and which shows a back face situated at a distance behind said visible surface formed by said plastic material.

20 25. A skin according to claim 24, characterised in that at least a structural backing layer is united to the back side of the manufactured skin, preferably through the intermediary of an intermediate foam layer, to form said trim part.

25 26. A skin according to claim 24 or 25, characterised in that the insert shows a front face which is recessed within the visible surface formed by the skin so that the skin forms a recess in front of the insert wherein a finishing element, covering the insert, can be fixed.

27. A skin according to claim 24 or 25, characterised in that the front face of the skin is at least partially separated from the visible surface formed by said plastic material of the skin by a gap.

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28. A skin according to claim 24 or 25, characterised in that said insert shows a front face which is covered by the plastic material of the skin.

5 29. A skin according to any one of the claims 24 to 28, characterised in that it is a flexible skin having in particular an average thickness in the range of 0.1 to 3 mm and more particularly in the range of 0.5 to 1.5 mm.

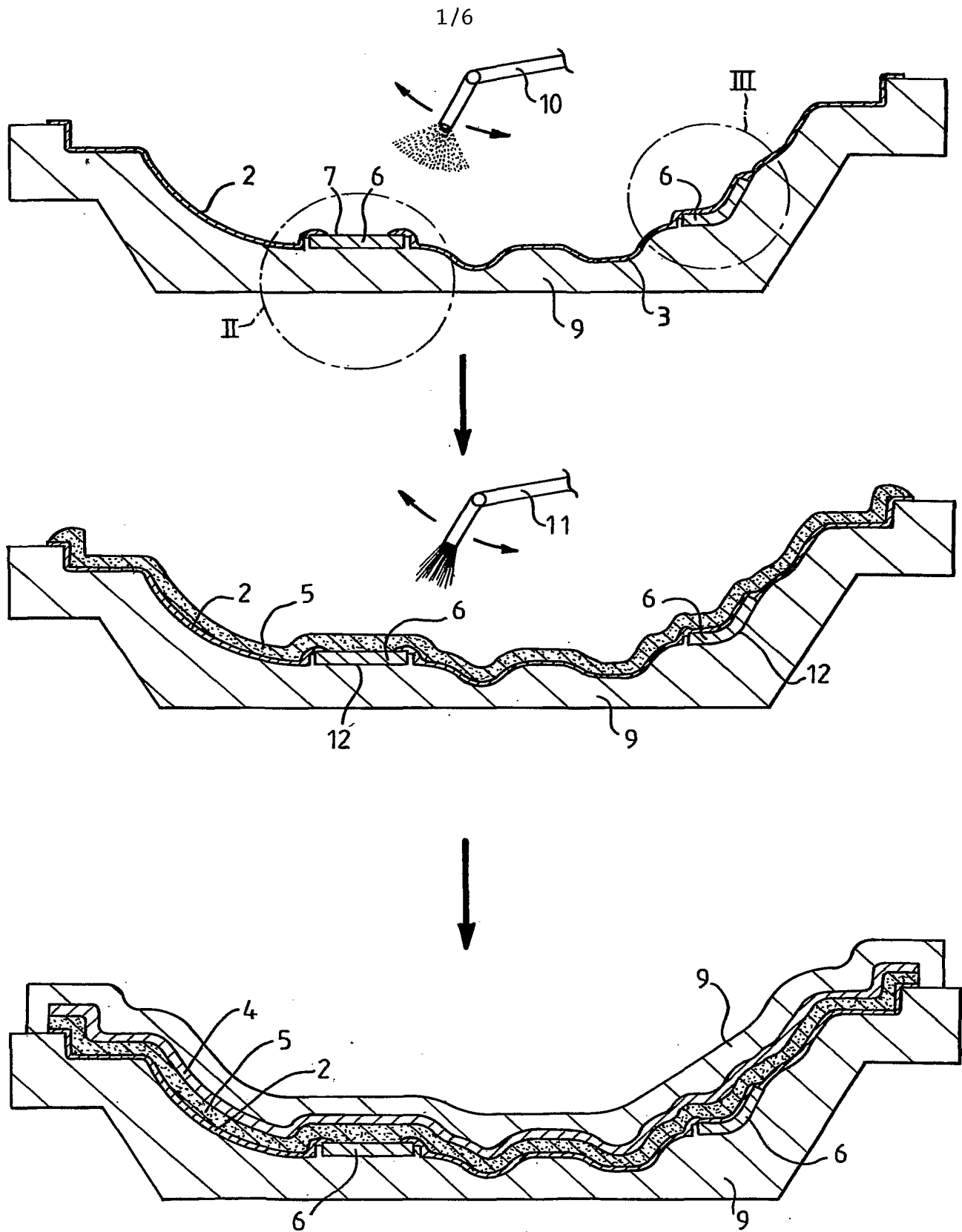


Fig. 1

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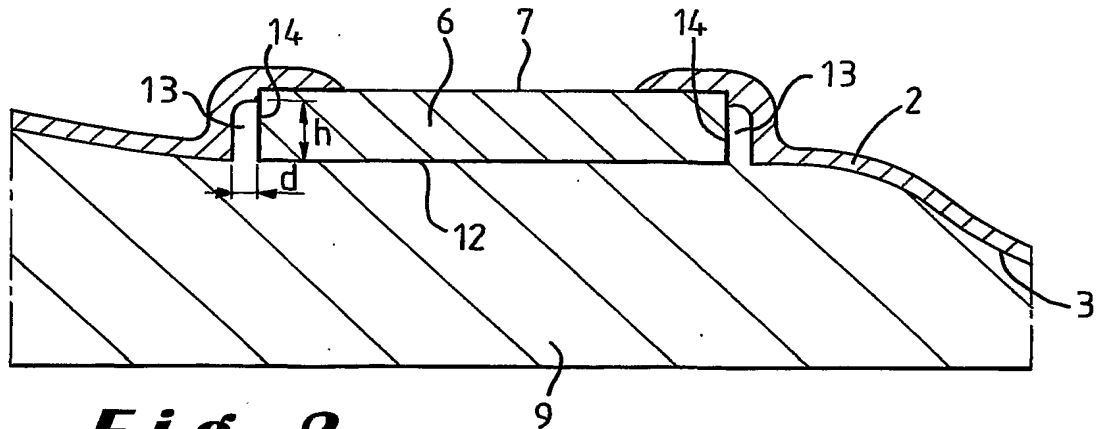


Fig. 2

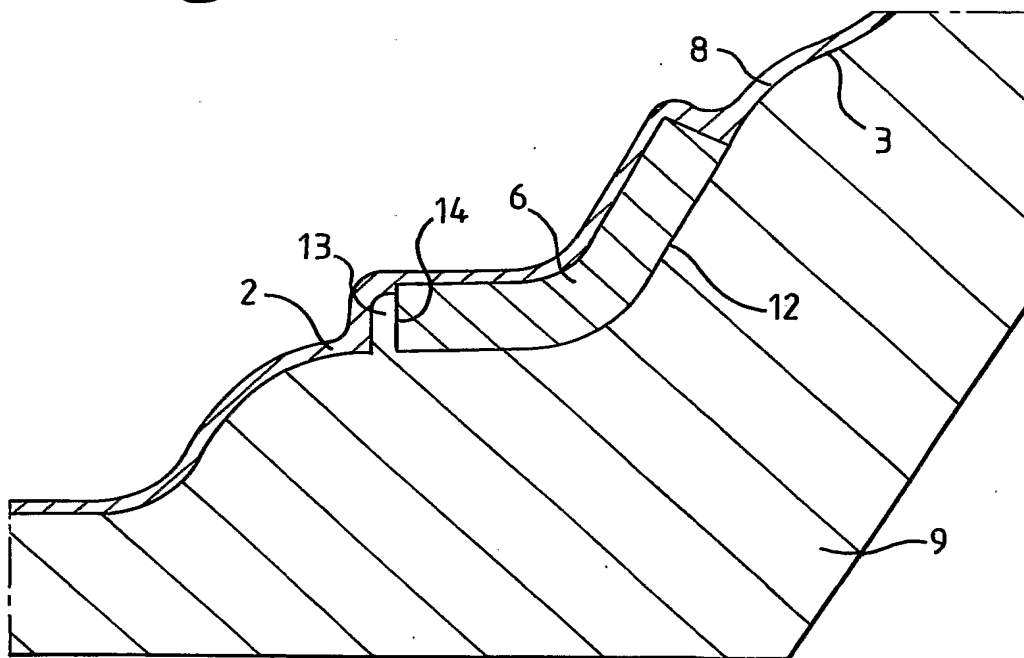


Fig. 3

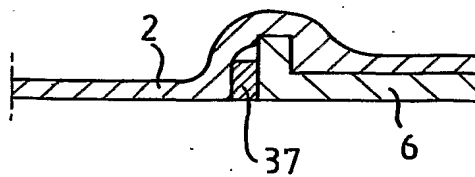


Fig. 4

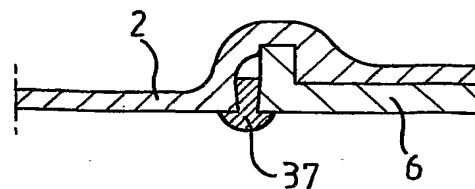


Fig. 5

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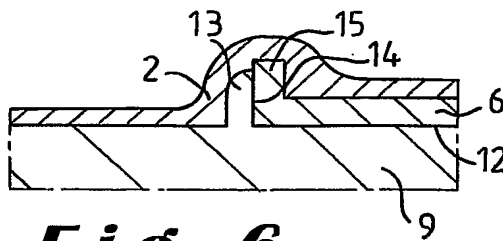


Fig. 6

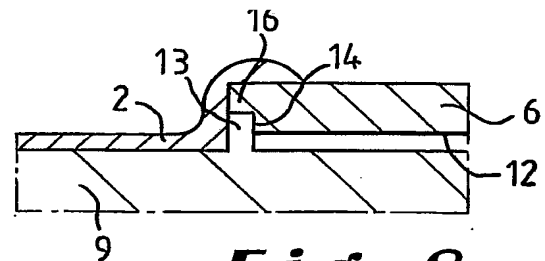


Fig. 8

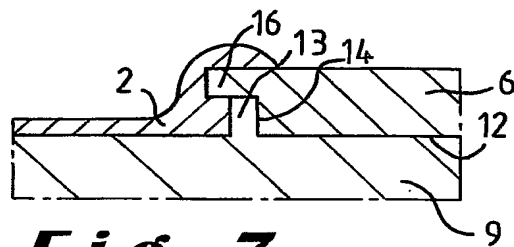


Fig. 7

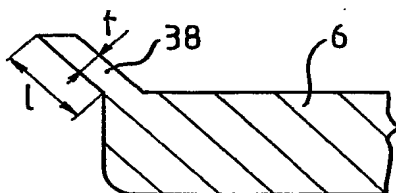


Fig. 9a

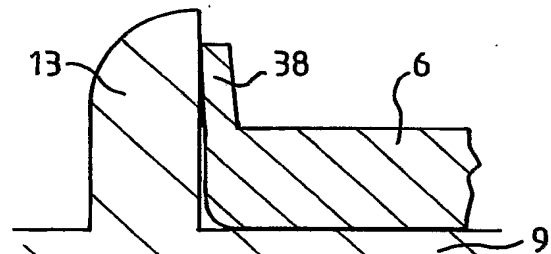


Fig. 9b

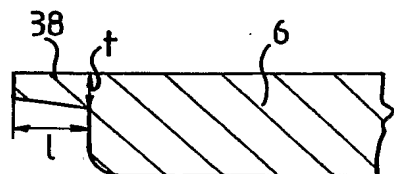


Fig. 10a

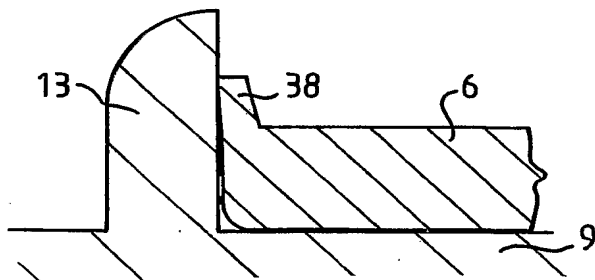


Fig. 10b

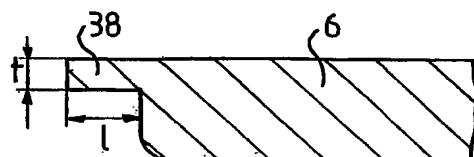


Fig. 11

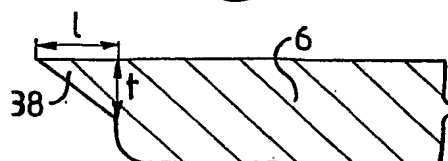


Fig. 12

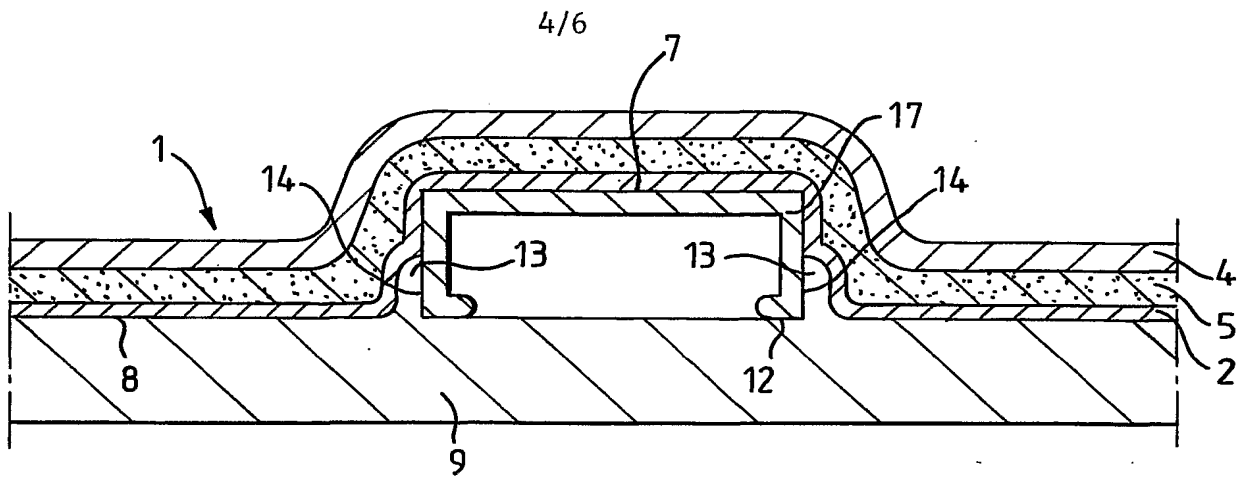


Fig. 13

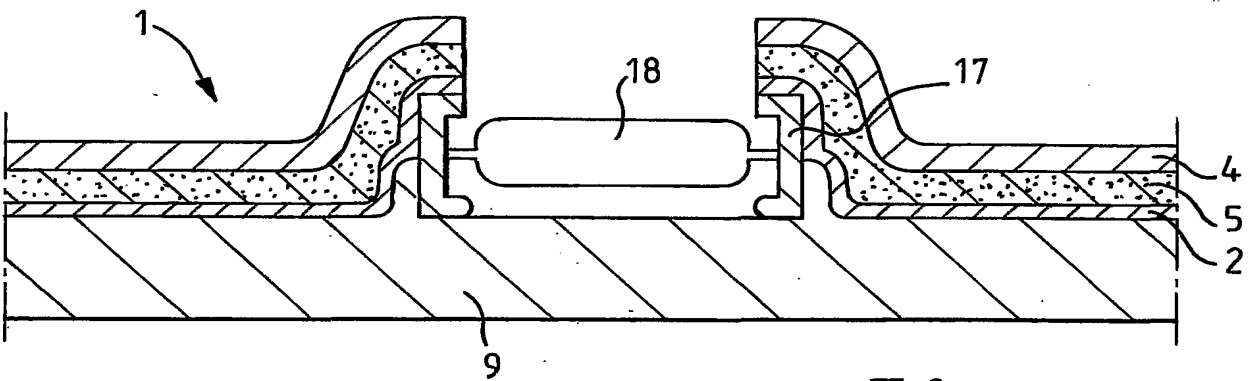


Fig. 14

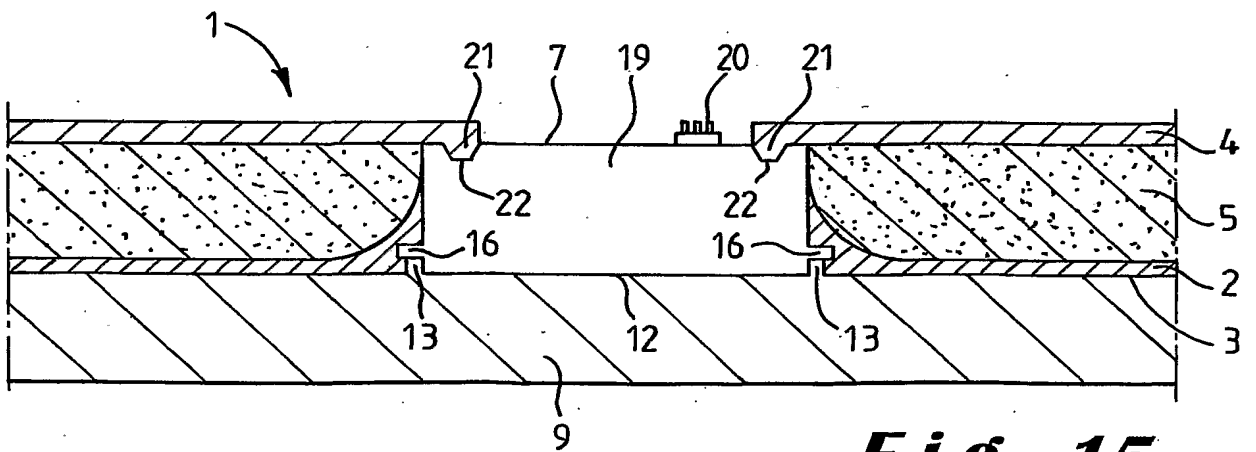


Fig. 15

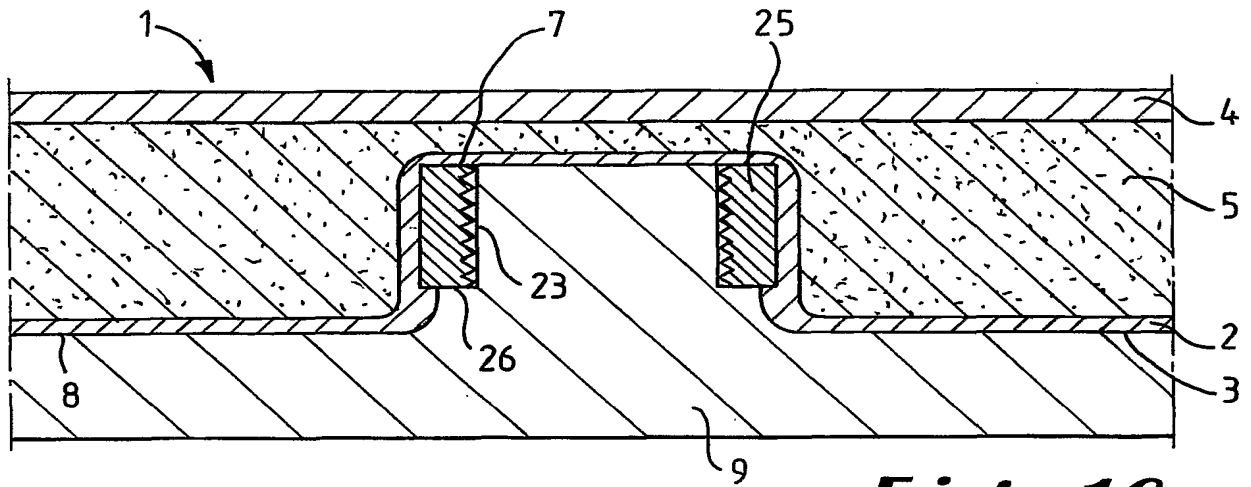


Fig. 16

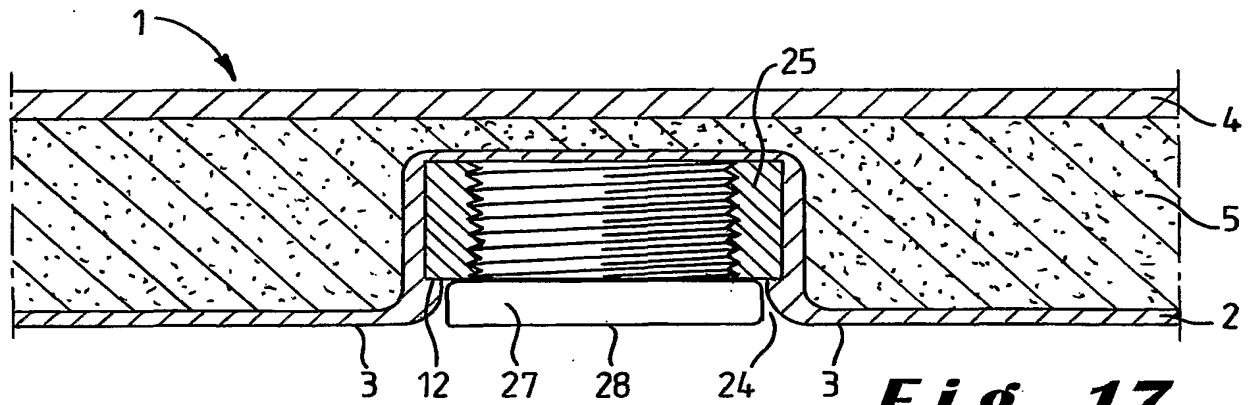


Fig. 17

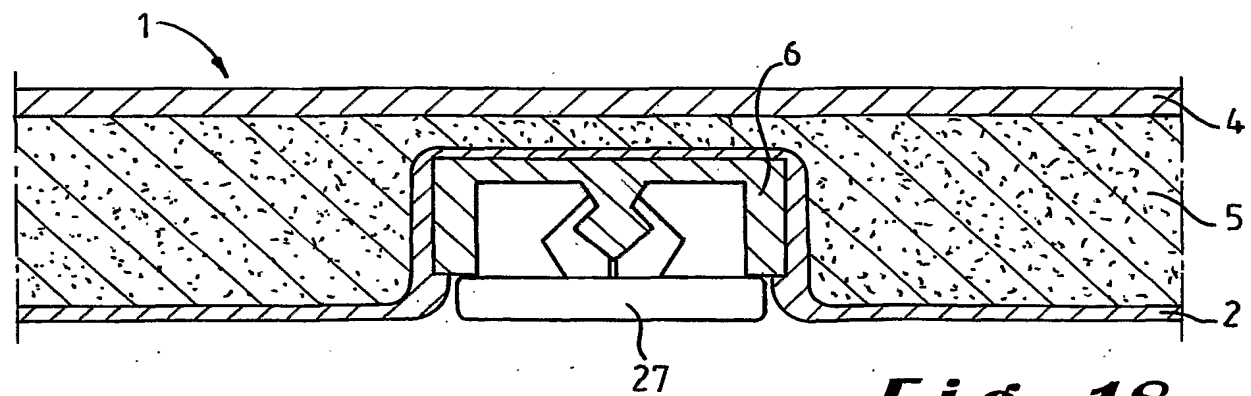


Fig. 18

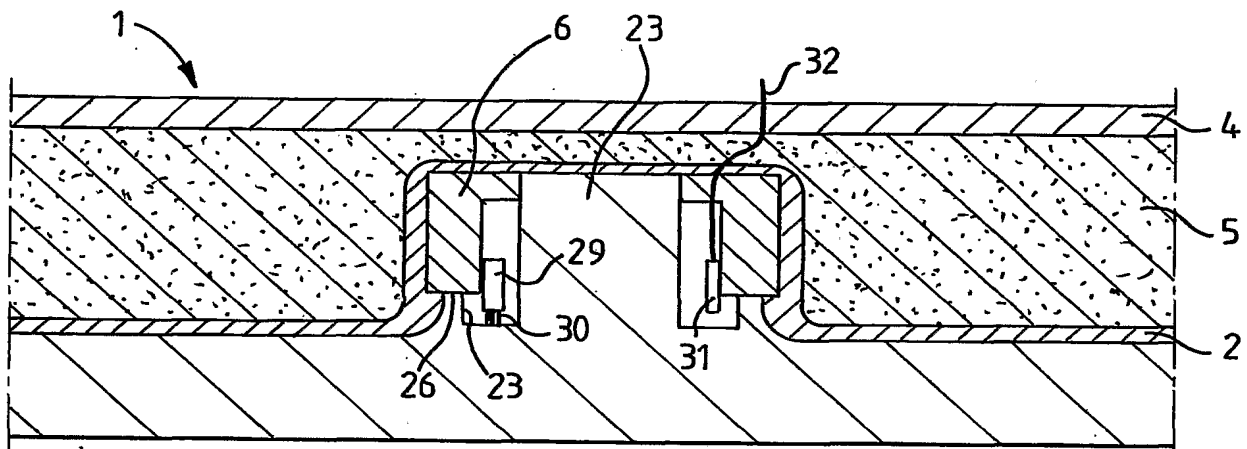


Fig. 19

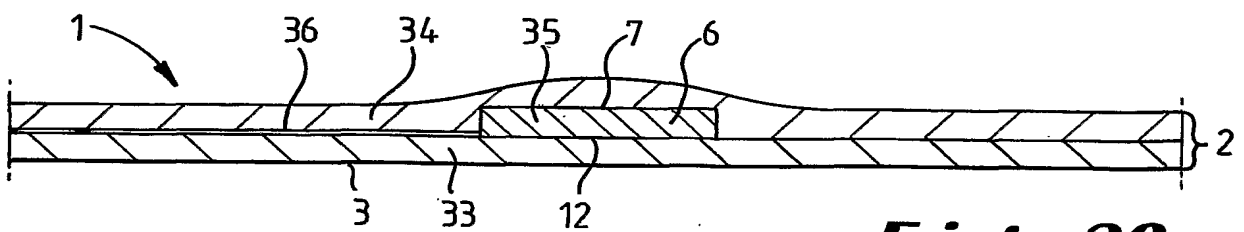


Fig. 20

INTERNATIONAL SEARCH REPORT

International Application No

PCT/BE 01/00124

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60R13/02 B29C41/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B60R B29C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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G document member of the same patent family

Date of the actual completion of the international search

22 November 2001

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/BE 01/00124

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